**Table S1.** Timeline for the development of natural and artificial enzymes.

| Year | Events | Reference |
|---|---|---|
| 1877 | The term "enzyme" was coined by Wilhelm Kuhne. | |
| 1926 | The enzyme urease was crystallized and determined to be a protein by James B. Sumner. | 1, 2 |
| 1946 | James B. Sumner won Nobel Prize in Chemistry "for his discovery that enzymes can be crystallized". | |
| 1965 | Cyclodextrin inclusion compounds were used to imitate enzymes. | 3, 4 |
| 1967-1968 | The idea of an RNA molecule with enzymatic properties was proposed by Carl R. Woese, Francis H. C. Crick and Leslie E. Orgel. | 5-7 |
| 1970 | The term "artificial enzyme" was coined by Ronald Breslow. | 8 |
| 1971 | Polymer with enzyme-like activity (synzyme) was reported by Irving M. Klotz. | 9 |
| 1972 | Molecularly imprinted polymers were invented by Günter Wulff and Irving M. Klotz. | 10, 11 |
| 1982 | The term "ribozyme" was coined by Thomas R. Cech. | 12 |
| 1982-1983 | The ribozymes were discovered by Sidney Altman and Thomas R. Cech. | 12, 13 |
| 1986 | Catalytic antibodies were invented by Peter G. Schultz and Richard A. Lerner. | 14, 15 |
| 1989 | Sidney Altman and Thomas R. Cech won Nobel Prize in Chemistry "for their discovery of catalytic properties of RNA". | |
| 1992 | The first artificial RNAzyme was selected. | 16 |
| 1993 | DNA cleavage induced by fullerene derivatives. | 17 |
| 1994 | The first DNAzyme was selected. | 18 |
| 1996-1997 | Fullerene derivatives as superoxide dismutase (SOD) mimic. | 19, 20 |
| 2004 | Nano gold as RNase mimic.<br>The term "nanozyme" was coined. | 21 |
| 2004 | Nano gold as oxidase mimic | 22 |
| 2005 | Nano ceria as SOD mimic. | 23 |
| 2007-2008 | Ferromagnetic nanoparticles as peroxidise mimic. | 24, 25 |
| 2009-2010 | Nano ceria as catalase and oxidase mimic. | 26 |
| 2011 | Nano $V_2O_5$ as haloperoxidase mimic | 27 |
| 2012 | Nano magnetoferritin as peroxidase mimic for tumor targeting. | 28 |
| 2012 | Hemin-graphene as NO synthase mimic. | 29 |
| 2014 | Integrated nanozymes for living organisms. | 30 |
| 2014 | Metal organic framework as protease mimic. | 31 |
| 2014 | Nano $V_2O_5$ as GSH-peroxidase mimic. | 32 |
| 2014 | Nano $MoO_3$ as sulfite oxidase mimic. | 33 |

| | | |
|---|---|---|
| 2015 | Allosteric regulation of nano gold-based nanozyme. | 34 |
| 2015 | Nanozyme strip for Ebola virus detection. | 35 |

**Note:**

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The cyclodextrin inclusion complex was adopted with permission from reference 4. Copyright (1965) American Chemical Society.

The ribozyme structure was adopted with permission from reference 36. Copyright (2009) American Chemical Society.

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The allosteric regulation of nano gold-based nanozyme was adopted with permission from reference 37. Copyright (2015) Nature Publishing Group.

The nanozyme strip was adopted with permission from reference 35. Copyright (2015) Elsevier.

**Table S2.** $H_2O_2$ detection with peroxidase mimics.

| **Nanozymes** | **Meth** | **Linear range** | **LOD** | **Comments** | **Ref** |
|---|---|---|---|---|---|
| $Fe_3O_4$ MNPs | Color. | 5-100 μM | 3 μM | Substrate: ABTS | 25 |
| $Fe_3O_4$ MNPs | Color. | 0.5-150.0 μM | 0.25 μM | Substrate: DPD<br>$H_2O_2$ in rainwater, honey, and milk was tested. | 38 |
| $Fe_3O_4$ MNPs | Color. | 1-100 μM | 0.5 μM | Substrate: TMB<br>$Fe_3O_4$ was encapsulated in mesoporous silica. | 39 |
| $Fe_3O_4$ graphene oxide composites | Color. | 1-50 μM | 0.32 μM | Substrate: TMB | 40 |
| Fe-substituted SBA-15 microparticles | Color. | 0.4-15 μM | 0.2 μM | Substrate: TMB | 41 |
| Iron phosphate microflowers | Color. | 10-50 μM | 10 nM | Substrate: TMB | 42 |
| $[Fe^{III}$(biuret-amide)] on mesoporous silica | Color. | 0.1-5 mM | 10 μM | Substrate: TMB | 43 |
| FeTe nanorods | Color. | 0.1-5 μM | 55 nM | Substrate: ABTS | 44 |
| Fe(III)-based coordination polymer | Color. | 1-50 μM | 0.4 μM | Substrate: TMB | 45 |
| $Fe_3O_4$ nanocomposites | Color. | 5-80 μM | 1.07 μM | Substrate: TMB<br>$Fe_3O_4$ was functionalized by $H_2$TCPP. | 46 |
| $Fe_3O_4$ nanocomposites | Color. | 0.5-200 μM | 0.2 μM | Substrate: TMB<br>$Fe_3O_4$ was functionalized by Casein. | 47 |
| GOx/$Fe_3O_4$/GO magnetic nanocomposites | Color. | 0.1-10 μM | 0.04 μM | Substrate: DPD | 48 |
| $Fe_3H_9(PO_4)_6$ $6H_2O$ crystals | Color. | 57.4-525.8 μM | 1 μM | Substrate: TMB | 49 |
| MIL-53(Fe) | Color. | 0.95-19 μM | 0.13 μM | Substrate: TMB<br>MIL-53(Fe) is a metal-organic framework. | 50 |
| CuO NPs | Color. | 0.01-1mM | N/A | Substrate: 4-AAP and phenol | 51 |
| AuNPs | Color. | 18-1100 μM | 4 μM | Substrate: TMB<br>Cysteamine was the ligand for AuNPs. | 52 |
| AuNC@BSA | Color. | 0.5-20 μM | 20 nM | Substrate: TMB | 53 |
| Au@Pt core/shell nanorods | Color. | 45-1000 μM | 45 μM | Substrate: OPD | 54 |
| NiTe thorny nanowires | Color. | 0.1-0.5 μM | 25 nM | Substrate: ABTS | 55 |
| Graphene oxide | Color. | 0.05-100 μM | 50 nM | Substrate: TMB | 56 |
| Hemin-graphene hybrid nanosheets | Color. | 0.05-500 μM | 20 nM | Substrate: TMB | 57 |
| Carbon nanodots | Color. | 1-100 μM | 0.2 μM | Substrate: TMB | 58 |
| Carbon nitride dots | Color. | 1-100 μM | 0.4 μM | Substrate: TMB | 59 |
| Tungsten carbide nanorods | Color. | 0.2-80 μM | 60 nM | Substrate: TMB | 60 |
| CoFe LDH nanoplates | Color. | 1-20 μM | 0.4 μM | Substrate: TMB | 61 |
| $Co_xFe_{3-x}O_4$ nanocubes | Color. | 1-60 μM | 0.36 μM | Substrate: TMB | 62 |
| Porphyrin functionalized $Co_3O_4$ nanostructures | Color. | 1-75 μM | 0.4 μM | Substrate: TMB | 63 |

| | | | | | |
|---|---|---|---|---|---|
| Carboxyl functionalized mesoporous polymer | Color. | 1-8 µM | 0.4 µM | Substrate: TMB | 64 |
| PtPd nanodendrites on graphene | Color. | 0.5-150 µM | 0.1 µM | Substrate: TMB | 65 |
| Pt-DNA complexes | Color. | 0.979-17.6 mM | 0.392 mM | Substrate: TMB<br>3.92 µM was detected with PVDF membrane. | 66 |
| MnSe NPs | Color. | 0.17-10 µM | 0.085 µM | Substrate: TMB | 67 |
| Prussian blue nanoparticles | Color. | 0.05-50 µM | 0.031 µM | Substrate: ABTS | 68 |
| MWCNTs-Prussian blue nanoparticles | Color. | 1 µM -1.5 mM | 100 nM | Substrate: TMB<br>Carbon nanotubes were filled with Prussian blue nanoparticles. | 69 |
| Polypyrrole nanoparticles | Color. | 5-100 µM | | Substrate: TMB<br>PPy has been used to quantitatively monitor macrophages-generated $H_2O_2$. | 70 |
| Polyoxometalate | Color. | 1-20 µM | 0.4 µM | Substrate: TMB | 71 |
| Polyoxometalate | Color. | 0.134-67 µM | 0.134 µM | Substrate: TMB | 72 |
| $Fe_3O_4$ MNPs | Fluor. | 10-200 nM | 5.8 nM | Substrate: Rhodamine B<br>Fluorescence of Rhodamine B was quenched. | 73 |
| $BiFeO_3$ NPs | Fluor. | 20 nM-20 µM | 4.5 nM | Substrate: BA<br>Oxidation of BA gave fluorescence.<br>$H_2O_2$ in rainwater was tested. | 74 |
| $Fe_3O_4$ MNPs | Fluor. | 0.18-900 µM | 0.18 µM | Fluorescence of CdTe QD was quenched. | 75 |
| $Fe_3O_4$ MNPs | Fluor. | 0.04-8 µM | 0.008 µM | Substrate: BA<br>Oxidation of BA gave fluorescence. | 76 |
| CuO NPs | Fluor. | 5-200 µM | 0.34 µM | Substrate: terephthalic acid<br>Terephthalic acid was oxidized by hydroxyl radical to form a highly fluorescent product | 77 |
| $Fe^{III}$-TAML | CL | 0.06-1 µM | 0.05 µM | | 78 |
| $CoFe_2O_4$ NPs | CL | 0.1-4 µM | 0.02 µM | $CoFe_2O_4$ NPs form complexes with beta-CD. | 79 |
| $CoFe_2O_4$ NPs | CL | 0.1-10 µM | 10 nM | $H_2O_2$ in natural water was tested. | 80 |
| $CoFe_2O_4$ NPs with chitosan coating | CL | 1 nM-4 µM | 0.5 nM | $CoFe_2O_4$ NPs was coated with chitosan.<br>$H_2O_2$ in natural water was tested. | 81 |
| $Fe_3O_4$ MNPs | E-chem | 4.2-800 µM | 1.4 µM | | 82 |
| $Fe_3O_4$ microspheres-AgNP hybrids | E-chem | 1.2-3500 µM | 1.2 µM | $H_2O_2$ in disinfected FBS samples was tested. | 83 |
| $Fe_3O_4$ MNPs | E-chem | 0-16 nM | 1.6 nM | $Fe_3O_4$ was loaded on CNT. | 84 |
| $Fe_3O_4$ MNPs | E-chem | 1-10 mM | N/A | $Fe_3O_4$ was entrapped in mesoporous carbon foam, and the composite was used to construct a carbon paste electrode.<br>Not a linear response. | 85 |
| $Fe_3O_4$ MNPs | E-chem | 20-6250 µM | 2.5 µM | $Fe_3O_4$ MNPs and PDDA-graphene formed multilayer via layer-by-layer assembly.<br>$H_2O_2$ in toothpaste was tested. | 86 |
| $Fe_3O_4$ nanofilms on TiN substrate | E-chem | 1-700 µM | 1 µM | $H_2O_2$ in Walgreens antiseptic/oral debriding agent, Crest whitening mouthwash solution, Diet coke, and Gatorade was tested. | 87 |
| $Fe_3O_4$ MNPs | E-chem | 0.2 mM-2 mM | 0.01 mM | | 88 |
| $Fe_3O_4$ MNPs | E-chem | 0.1-6 mM | 3.2 µM | $Fe_3O_4$ was on reduced graphene oxide. | 89 |
| $Fe_2O_3$ NPs | E-chem | 20-140 µM | 11 µM | | 90 |

| | | | | | |
|---|---|---|---|---|---|
| $Fe_2O_3$ NPs | E-chem | 20-300 μM | 7 μM | $Fe_2O_3$ was modified with Prussian blue. | 90 |
| Iron oxide NPs/CNT | E-chem | 0.099-6.54 mM | 53.6 μM | | 91 |
| $Fe_3O_4$/self-reduced graphene nanocomposites | E-chem | 0.001-20 mM | 0.17 μM | CdTe QDs stimulated extracellular $H_2O_2$ release from HeLa cells was detected. | 92 |
| FeS nano-sheet | E-chem | 0.5-150 μM | 92 nM | | 93 |
| FeS needle | E-chem | 5-140 μM | 4.3 μM | | 94 |
| FeSe NPs | E-chem | 5-100 μM | 3.0 μM | | 94 |
| FeS | E-chem | 10-130 μM | 4.03 μM | | 95 |
| $Co_3O_4$ NPs | E-chem | 0.05-25 mM | 0.01 mM | | 96 |
| Hemin-graphene hybrid nanosheets | E-chem | 0.5-400 μM | 0.2 μM | | 57 |
| LDH-hemin nanocomposite | E-chem | 1-240 μM | 0.3 μM | | 97 |
| Helical CNT | E-chem | 0.5-115 μM | 0.12 μM | | 98 |
| LDH nanoflakes | E-chem | 12-254 μM | 2.3 μM | | 99 |
| Calcined LDH | E-chem | 1-100 μM | 0.5 μM | | 100 |
| CdS | E-chem | 1-1900 μM | 0.28 μM | | 101 |

**Table S3.** Targets detection combining oxidases and peroxidase mimics.

| Nanozymes | Meth | Linear range | LOD | Comments | Ref |
|---|---|---|---|---|---|
| Glucose | | | | | |
| $Fe_3O_4$ MNPs | Color. | 50-1000 μM | 30 μM | Substrate: ABTS<br>Selectivity against sugars: fructose, lactose, and maltose. | 25 |
| $Fe_3O_4$ MNPs with PDDA coating | Color. | 39-100 μM | 30 μM | Substrate: ABTS<br>GOx was electrostatically assembled onto the $Fe_3O_4$@PDDA.<br>Glucose in serum samples was tested.<br>Compared with glucometer.<br>Selectivity against sugars: galactose, lactose, mannose, maltose, arabinose, cellobiose, raffinose, and xylose. | 102 |
| $Fe_3O_4$ MNPs | Color. | 30-1000 μM | 3 μM | Substrate: TMB<br>$Fe_3O_4$ was encapsulated in mesoporous silica with GOx.<br>Showing the recycle capability.<br>Comparison between free MNPs vs encapsulated MNPs. | 39 |
| $Fe_3O_4$/GO composites | Color. | 2-200 μM | 0.74 μM | Substrate: TMB<br>Glucose in urine was tested. | 40 |
| $Fe_3O_4$ nanocomposites | Color. | 5-25 μM | 2.21 μM | Substrate: TMB<br>$Fe_3O_4$ was functionalized by $H_2$TCPP. | 46 |
| $Fe_3O_4$ and GOx nanocomposites | Color. | 3-1000 μM | 1.0 μM | Substrate: TMB<br>$Fe_3O_4$ was functionalized by Casein. | 47 |
| GOx/$Fe_3O_4$/GO magnetic nanocomposite | Color. | 0.5-600 μM | 0.2 μM | Substrate: DPD | 48 |
| γ-$Fe_2O_3$ nanoparticles | Color. | 1-80 μM | 0.21 μM | Substrate: TMB<br>Glucose in blood and urine was tested. | 103 |
| Graphite-like carbon nitrides | Color. | 5-100 μM | 0.1 μM | Substrate: TMB<br>Glucose in serum was tested. | 104 |
| Iron oxide NPs | Color. | 31.2-250 μM | 8.5 μM | Substrate: ABTS<br>Iron oxide NPs was coated with glycine.<br>More robust than HRP towards $NaN_3$ inhibition. | 105 |
| Iron oxide NPs | Color. | 31.2-250 μM | 15.8 μM | Substrate: ABTS<br>Iron oxide NPs was coated with heparin.<br>More robust than HRP towards $NaN_3$ inhibition. | 105 |
| Iron oxide NPs | Color. | 0.12-4 μM | 0.5 μM | Substrate: ABTS<br>Iron oxide NPs was coated with APTES and MPTES. | 106 |
| $ZnFe_2O_4$ | Color. | 1.25-18.75 μM | 0.3 μM | Substrate: TMB<br>Glucose in urine was tested. | 107 |
| [$Fe^{III}$(biuret-amide)] on mesoporous silica | Color. | 20-300 μM | 10 μM | Substrate: TMB<br>Glucose in mice blood plasma was tested. | 43 |
| FeTe nanorods | Color. | 1-100 μM | 0.38 μM | Substrate: ABTS<br>Glucose in spiked blood was tested. | 44 |
| Fe(III)-based coordination polymer | Color. | 2-20 μM | 1 μM | Substrate: TMB<br>Glucose in serum was tested. | 45 |
| Mesoporous $Fe_2O_3$-graphene nanostructures | Color. | 0.5-10 μM | 0.5 μM | Substrate: TMB<br>Glucose in serum was tested. | 108 |
| CuO NPs | Color. | 0.1-8 mM | N/A | Substrate: 4-AAP and phenol | 51 |
| $V_2O_5$ nanowires and gold nanoparticles | Color. | 0-10 μM | 0.5 μM | Substrate: ABTS | 109 |

| | | | | | |
|---|---|---|---|---|---|
| nanocomposite | | | | | |
| AuNPs | Color. | 2.0-200 µM | 0.5 µM | Substrate: TMB<br>Cysteamine was the ligand for AuNPs. | 52 |
| Au@Pt core/shell nanorods | Color. | 45-400 µM | 45 µM | Substrate: OPD | 54 |
| NiTe thorny nanowires | Color. | 1-50 µM | 0.42 µM | Substrate: ABTS | 55 |
| MnSe NPs | Color. | 8-50 µM | 1.6 µM | Substrate: TMB | 67 |
| Graphene oxide | Color. | 1-20 µM | 1 µM | Substrate: TMB<br>Glucose in blood and fruit juice was tested. | 56 |
| Graphene oxide | Color. | 2.5-5 mM | 0.5 µM | Substrate: TMB<br>Graphene oxide was functionalized by chitosan. | 110 |
| Hemin-graphene hybrid nanosheets | Color. | 0.05-500 µM | 30 nM | Substrate: TMB | 57 |
| Carbon nanodots | Color. | 1-500 µM | 1 µM | Substrate: TMB<br>Glucose in serum was tested. | 58 |
| Carbon nitride dots | Color. | 1-5 µM | 0.5 µM | Substrate: TMB | 59 |
| MWCNTs-Prussian blue nanoparticles | Color. | 1 µM -1 mM | 200 nM | Substrate: TMB<br>Carbon nanotubes were filled with Prussian blue nanoparticles. | 69 |
| CoFe LDH nanoplates | Color. | 1-10 mM | 0.6 µM | Substrate: TMB | 61 |
| $Co_xFe_{3-x}O_4$ nanocubes | Color. | 8-90 µM | 2.47 µM | Substrate: TMB | 62 |
| $MoS_2$ nanosheets | Color. | 5-150 µM | 1.2 µM | Substrate: TMB<br>Glucose in serum was tested. | 111 |
| $WS_2$ nanosheets | Color. | 5-300 µM | 2.9 µM | Substrate: TMB<br>Glucose in serum of health persons and diabetes persons was tested. | 112 |
| Prussian blue nanoparticles | Color. | 0.1-50 µM | 0.03 µM | Substrate: ABTS | 68 |
| $Fe_3O_4$ MNPs | Fluor. | 1.6-160 µM | 1.0 µM | Fluorescence of CdTe QD was quenched.<br>Glucose in serum was tested. | 75 |
| $Fe_3O_4$ MNPs | Fluor. | 0.05-10 µM | 0.025 µM | Substrate: benzoic acid<br>Oxidation of BA gave fluorescence.<br>Glucose in serum was tested. | 76 |
| $Fe_3O_4$ MNPs with PDDA coating | Fluor. | 3-9 µM | 3 µM | GOx was electrostatically assembled onto the $Fe_3O_4$@PDDA.<br>Oxidation of AU gave fluorescence.<br>Glucose in serum was tested.<br>Selectivity against sugars: arabinose, cellobiose, galactose, lactose, maltose, raffinose, and xylose. | 113 |
| $BiFeO_3$ NPs | Fluor. | 1-100 µM | 0.5 µM | Oxidation of BA gave fluorescence.<br>Glucose in serum was tested. | 74 |
| $CoFe_2O_4$ NPs | CL | 0.1-10 µM | 0.024 µM | Other sugars | 80 |
| $CoFe_2O_4$ NPs | CL | 0.05-10 µM | 10 nM | $CoFe_2O_4$ NPs were coated with chitosan.<br>Glucose in serum was tested. | 81 |
| Hemin-graphene hybrid nanosheets | E-chem | 0.5-400 µM | 0.3 µM | | 57 |
| $Fe_3O_4$ MNPs | E-chem | 0.5-10 mM | 0.2 mM | $Fe_3O_4$ was encapsulated in mesoporous carbon with GOx, and the composite was used to construct a carbon paste electrode.<br>Comparison between free MNPs vs encapsulated MNPs. | 85 |
| $Fe_3O_4$ MNPs | E-chem | 6-2200 µM | 6 µM | Glucose in serum was tested.<br>Compared with clinical analyzer.<br>Nafion for high selectivity against AA, UA, sucrose, and lactose. | 114 |

| | | | | | |
|---|---|---|---|---|---|
| $Fe_3O_4$-enzyme-polypyrrole nanoparticles | E-chem | 0.5 µM-34 mM | 0.3 µM | Glucose in serum was tested. | 115 |
| Ascorbic acid | | | | | |
| MIL-53(Fe) | Color. | 28.6-190.5 µM | 15 µM | Substrate: TMB<br>MIL-53(Fe) is a metal-organic framework. | 50 |
| Dopamine | | | | | |
| $Co_xFe_{3-x}O_4$ nanoparticles | Color. | 0.6-8 µM | 0.13 µM | Substrate: TMB<br>Dopamine in serum was tested. | 116 |
| Thrombin | | | | | |
| Ag/Pt bimetallic nanoclusters | Color. | 1-50 nM | 2.6 nM | Ag/Pt bimetallic nanoclusters was produced through a DNA-templated method. | 117 |
| Glutathione | | | | | |
| Fe-MIL-88$NH_2$ MOF | Color. | 1-100 µM | 0.45 µM | Substrate: TMB | 118 |
| Cysteine | | | | | |
| Fe-MIL-88$NH_2$ MOF | Color. | 1-80 µM | 0.39 µM | Substrate: TMB | 118 |
| Homocysteine | | | | | |
| Fe-MIL-88NH2 MOF | Color. | 1-80 µM | 0.40 µM | Substrate: TMB | 118 |
| Choline | | | | | |
| $Fe_3O_4$ MNPs with PDDA coating | Fluor. | 20-100 µM | 20 µM | Choline oxidase was electrostatically assembled onto the $Fe_3O_4$@PDDA.<br>Oxidation of AU gave fluorescence. | 113 |
| $Fe_3O_4$ MNPs | E-chem | 1 nM-10 mM (log) | 0.1 nM | $Fe_3O_4$ and choline oxidase were immobilized together on electrode.<br>Selectivity against AA and UA. | 119 |
| Platinum nanoparticles | Color. | 6-400 µM | 2.5 µM | Substrate: N-ethyl-N-(3-sulfopropyl)-3-methylaniline sodium salt and 4-amino-antipyrine | 120 |
| Acetylcholine | | | | | |
| $Fe_3O_4$ nanospheres/reduced graphene oxide | Color. | 100 nM-10 mM | 39 nM | Substrate: TMB | 121 |
| Platinum nanoparticles | Color. | 10-200 µM | 2.84 µM | Substrate: N-ethyl-N-(3-sulfopropyl)-3-methylaniline sodium salt and 4-amino-antipyrine | 120 |
| Glutathione | | | | | |
| Carbon nanodots | Color. | 0-7 µM | 0.3 µM | Substrate: TMB | 122 |
| Cholesterol | | | | | |
| $Fe_3O_4$ MNPs | Color. | 10-250 µM | 5 µM | Substrate: TMB<br>$Fe_3O_4$ was encapsulated in mesoporous silica with cholesterol oxidase.<br>Showing the recycle capability.<br>Comparison between free MNPs vs encapsulated MNPs. | 39 |
| Au@Pt core/shell nanorods | Color. | 30-300 µM | 30 µM | Substrate: OPD | 54 |
| Galactose | | | | | |
| $Fe_3O_4$ MNPs | Color. | 10-200 mg/L | 5 mg/L | Substrate: ABTS<br>Galactose in dried blood samples from normal persons and patients was tested.<br>Plates were used for sensing. | 123 |
| $Fe_3O_4$ MNPs with PDDA coating | Fluor. | 2-80 µM | 2 µM | Galactose oxidase was electrostatically assembled onto the $Fe_3O_4$@PDDA.<br>Oxidation of AU gave fluorescence. | 113 |
| Melamine | | | | | |
| Bare gold nanoparticles | Color. | 1-800 nM | 0.2 nM | Substrate: TMB | 124 |
| Kanamycin | | | | | |
| Gold nanoparticles | Color. | 1-100 nM | 1.49 nM | Substrate: TMB | 125 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | Gold nanoparticles were modified by kanamycin aptamer. | |
| Xanthine | | | | | |
| AuNC@BSA | Color. | 1-200 μM | 0.5 μM | Substrate: TMB<br>Xanthine in serum and urine samples was tested. | 53 |
| Mercury(II) | | | | | |
| Ag nanoparticles | Color. | 0.5-800 nM | 0.125 nm | Substrate: TMB<br>Mercury(II) in blood and wastewater was tested. | 126 |
| Carbon nanodots | Color. | 0-0.46 μM | 23 nM | Substrate: TMB | 127 |
| Platinum nanoparticle | Color. | 0.01-4 nM | 8.5 pM | Substrate: TMB | 128 |
| Calcium ion | | | | | |
| $Co_3O_4$ Nanomaterials | E-chem | 0.1-1 mM | 4 μM | The calcium ion in a milk sample was tested. | 129 |

**Table S4.** Nanozyme as peroxidase mimics for immunoassay.

| **Nanozyme** | **Target** | **Format** | **Comments** | **Ref** |
|---|---|---|---|---|
| $Fe_3O_4$ NPs with dextran coating | preS1 | antigen-down immunoassay | | 24 |
| | TnI | capture-detection sandwich immunoassay | | |
| $Fe_3O_4$ NPs with chitosan coating | mouse IgG | antigen-down immunoassay | | 130 |
| | CEA | capture-detection sandwich immunoassay | | |
| | CEA | sandwich immunoassay | | |
| $Fe_2O_3$ NPs with Prussian blue coating | IgG | antigen-down immunoassay | | 131 |
| Ferric nano-core residing in ferritin | avidin | antigen-down immunoassay | avidin-biotin interaction | 132 |
| | nitrated human ceruloplasmin | sandwich immunoassay | | |
| $Fe_{(1-x)}Mn_xFe_2O_4$ NPs with PMIDA coating | mouse IgG | antigen-down immunoassay | both direct and indirect assay | 133 |
| $MnFe_2O_4$ NPs with citric acid coating | sticholysin II | antigen-down immunoassay | | 134 |
| Fe-TAML | human IgG | antigen-down immunoassay | Fe-TAML was encapsulated inside mesoporous silica nanoparticles. | 135 |
| $Co_3O_4$ nanoparticles | vascular endothelial growth factor | antigen-down immunoassay | | 136 |
| Platinum nanoparticles | cytokeratin 19 fragments | sandwich immunoassay | | 137 |
| Platinum nanoparticles on graphene oxide | folate receptors | antigen-down immunoassay | | 97 |
| Gold nanoparticles-graphene oxide hybrids | respiratory syncytial virus | sandwich immunoassay | The peroxidase-like activity of gold nanoparticles-graphene oxide hybrids was enhanced by mercury(II). | 138 |
| Rod-shaped Au@PtCu | human IgG | antigen-down immunoassay | The detection limit was 90 pg/mL. | 139 |
| Au@Pt nanorods with PSS coating | mouse IL-2 | sandwich immunoassay | | 140 |
| Graphene oxide | PSA | sandwich immunoassay | Clinical samples were tested. | 141 |

**Table S5.** Comparison of the kinetic parameters of selected nanozymes and protein enzymes.

| **Catalyst** | $K_{cat}$ | $K_m$ | $V_{max}$ | **Substrate** | **Ref** |
|---|---|---|---|---|---|
| Peroxidase and it mimics | | | | | |
| $Fe_3O_4$ NPs | $3.02 \times 10^4$ $s^{-1}$ | 0.098 mM | $3.44 \times 10^{-8}$ M $s^{-1}$ | TMB | 142 |
| HRP | $4.00 \times 10^3$ $s^{-1}$ | 0.434 mM | $10.00 \times 10^{-8}$ M $s^{-1}$ | TMB | |
| Hemin-graphene | 246 $min^{-1}$ | 1.22 mM | N.A. | Pyrogallol | 143 |
| HRP | 1750 $min^{-1}$ | 0.81 mM | N.A. | Pyrogallol | |
| GO-COOH | N.A. | $0.0237 \pm 0.001$ mM | $(3.45 \pm 0.31) \times 10^{-8}$ M $s^{-1}$ | TMB | 56 |
| HRP | N.A. | $0.214 \pm 0.014$ mM | $(2.46 \pm 0.32) \times 10^{-8}$ M $s^{-1}$ | TMB | |
| Vanadia nanowires | 0.065 $s^{-1}$ | 2.22 mM | 0.83 mM $min^{-1}$ | GSH | 32 |
| GPx1 enzyme | N.A. | 10 mM | N.A. | GSH | |
| $V_2O_5$ nanowires | $2.5 \times 10^3$ $s^{-1}$ | 0.4 μM | 0.2807 M $s^{-1}$ | ABTS | 27 |
| Oxidase and it mimics | | | | | |
| $MoO_3$-TPP nanoparticles | $2.78 \pm 0.09$ $s^{-1}$ | $0.59 \pm 0.02$ mM | 1.13 μM·$min^{-1}$ | $SO_3^{2-}$ | 33 |
| native human SuOx | 16 $s^{-1}$ | 0.017 mM | N.A. | $SO_3^{2-}$ | |
| polymer-coated nanoceria | N.A. | 3.8 mM | 0.7 μM·$s^{-1}$ | TMB | 26a |

## Abbreviations

| | |
|---|---|
| AA | ascorbic acid |
| 4-AAP | 4-aminoatipyrine |
| ABTS | 2,2'-azino-di(3-ethylbenzthiazoline-6-sulfonic acid) |
| APTES | (3-aminopropyl)triethoxysilane |
| AU | amplex ultrared |
| BA | benzoic acid |
| CD | cyclodextran |
| CEA | carcinoembryonic antigen |
| CNT | carbon nanotubes |
| Color. | colorimetric |
| DPD | N,N-diethyl-p-phenylenediamine |
| E-chem | electrochemical |
| Fluor. | fluorometric |
| GOx | glucose oxidase |
| GPx1 | glutathione peroxidase 1 |
| $H_2$TCPP | 5,10,15,20-tetrakis(4-carboxyphenyl)-porphyrin |
| HRP | horseradish peroxidase |
| IgG | immunoglobin G |
| LDH | layered double hydroxide |
| LOD | limit of detection |
| Meth | methods |
| MNPs | magnetic nanoparticles |
| MPTES | mercaptopropyltriethoxysilane |
| MWCNT | multi-walled carbon nanotubes |
| NPs | nanoparticles |
| OPD | o-phenylenediamine |
| PDDA | poly(diallyldimethylammonium chloride) |
| PMIDA | N-phosphonomethyl iminodiacetic acid |
| PSA | prostate specific antigen |
| PVDF | polyvinylidene difluoride |
| QD | quantum dot |
| Ref | references |
| SuOx | sulfite oxidase |
| TAML | tetraamidomacrocyclic ligand |
| TMB | 3,3',5,5'-tetramethylbenzidine |
| UA | uric acid |

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